UCLA MATTEL Children's Hospital

Fighting pediatric epilepsy with the ketogenic diet

While many individuals with epilepsy respond to pharmacologic treatment, 20 to 30 percent develop medically refractory epilepsy, also known as intractable or drug-resistant epilepsy. For this group, alternative non-pharmacologic treatments, including diet therapy, can sometimes be more beneficial than further trials of seizure medications.

Originally developed in the 1920s, the ketogenic diet is a special high-fat, low-carbohydrate diet that is often recommended by UCLA physicians for controlling seizures in pediatric patients with drug-resistant epilepsy. Traditionally, the ketogenic diet has been reserved as a treatment of last resort — after the failure of three or more anticonvulsant medications — due to possible side effects and adherence difficulty. A randomized, controlled trial in children with daily seizures in spite of multiple failed medication trials demonstrated that the ketogenic diet was associated on average with an almost 40 percent reduction in seizure frequency, with some patients experiencing a greater than 90 percent seizure reduction or seizure freedom.

Established two decades ago, UCLA's Ketogenic Diet Program is one of the largest in existence and has helped hundreds of pediatric patients over the years, managing roughly 60 to 70 pediatric patients on the diet at any given time.

Overcoming fears and misinformation

"Some parents and patients may be turned off by the lifestyle changes required by the ketogenic diet, or be afraid of the side effects. But under a carefully monitored program, the benefits greatly outweigh the risks," says Joyce Matsumoto, MD, associate health sciences clinical professor in pediatric neurology and director of UCLA's Ketogenic Diet Program. "It is a big commitment, but if you happen to be one of those with a good response, you will know fairly quickly," Dr. Matsumoto says. "When a child fails multiple seizure medications, I encourage families to at least take the opportunity to find out."

The diet has been introduced in infants as young as 1 month old, but typically it is administered to toddlers and school-age children. For older kids, adolescents and adults who can't tolerate the lack of flexibility imposed by the ketogenic diet, other options include a less-restrictive Modified Atkins' Diet.

Registered dietitians, nurse practitioners and physicians closely supervise nutrition and fluid status, and provide laboratory monitoring at least once every three months. Children on the ketogenic diet continue to see their neurologist and take seizure medicines, although many who show a positive response are able to take smaller doses or fewer medicines.

Switching the body's fuel source

Normally, the body burns carbohydrates to produce energy. However, by limiting carbohydrate intake, the body turns to alternative fuel sources, primarily fat. Fat is converted in the liver into fatty acids and ketone bodies. It is not known exactly why the ketogenic diet works, but an elevated level of ketones in the body, or ketosis, is associated with a reduction in epileptic seizure occurrence.

The standard American diet includes about a 0.3:1 ratio of fat to carbohydrates plus protein. The ketogenic diet aims for a 3:1 to 4:1 ratio. The types of food that provide added fat for the ketogenic diet include butter, heavy whipping cream, mayonnaise and oils such as canola, coconut or olive. Meals must be prepared carefully, with a weighed amount of fruits and vegetables. No traditional sweets or carbohydrates, such as bread, rice or other starches, can be consumed, although ketogenic substitutes for many foods have been developed. If the child goes off the diet for even one meal, it may affect the outcome.

The diet is not without side effects, including constipation, dehydration, kidney stones and vitamin deficiency. For this reason, patients in UCLA's Ketogenic Diet Program are closely monitored by a dietitian and nurse practitioner at regular office visits every one to three months. Before admitting a patient to the program, UCLA physicians conduct a comprehensive medical evaluation and screen for fat metabolism disorders, weight deficiency, dehydration issues, history of kidney stones, food allergies and intolerances, as well as behavioral or personality traits that may interfere with adherence to the diet.

Implementation during supervised hospital stay

After screening, the child will be given fluid intake goals. Ketones in the body can be overly acidic, and to avoid kidney stones, children need to drink plenty of fluids. The fluid goals also serve as a test as to whether strict dietary guidelines can be followed.

Once admitted to the program, the diet is implemented during an inpatient stay at UCLA Mattel Children's Hospital. On the first day, children drink ketogenic "eggnog" shakes. On the second day, they start with full-strength breakfast and proceed from there. Parents receive instruction during the hospital stay regarding implementing the diet at home, including watching for side effects, such as excessive acidosis and hypoglycemia, and what measures to take to counter them. Hospital staff monitor blood sugar and urine ketones daily during the hospital stay; the child can go home once they have a moderate level of ketones in their urine and can tolerate three meals without hypoglycemia or vomiting. The average stay is about four to five days.

UCLA MATTEL Children's Hospital

Participating team members

Joyce Matsumoto, MD
Associate Clinical Professor
Pediatric Neurology

Director, Ketogenic Diet Therapies Program

Director, Pediatric Epilepsy Fellowship Training Program

Director, Pediatric Neurophysiology Laboratory

Natalie Ziegler, NP
Nurse Practitioner, Pediatric Neurology

Sarika Sewak, MPH, RD
Dietitian

Jennifer White, RD
Dietitian

Contact information

UCLA Pediatric Neurology
10833 Le Conte Avenue
22-474 MDCC Box 951752
Los Angeles, CA 90095

310-825-0867 Appointments and referrals
310-825-6196 Information

uclahealth.org/KetogenicDiet